

Measurement of Resonance Driving Terms

RHIC Beam Experiments workshop 2003

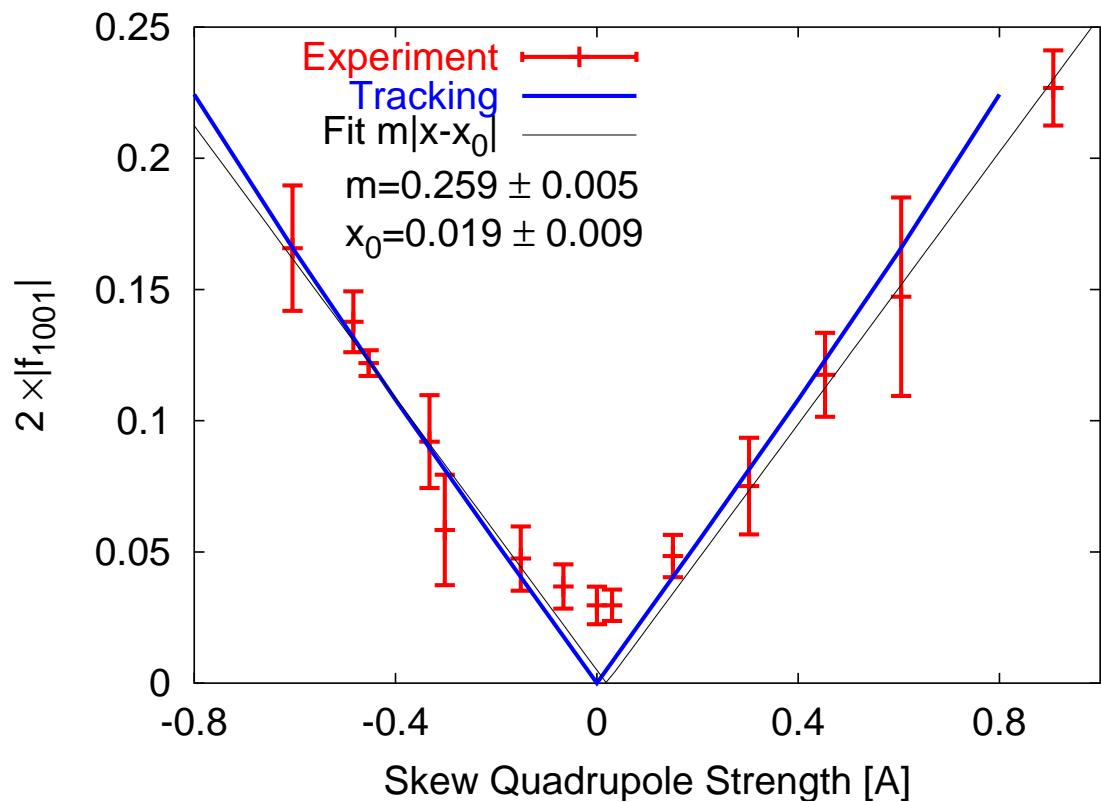
Rogelio Tomás

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- Past achievements in SPS and RHIC
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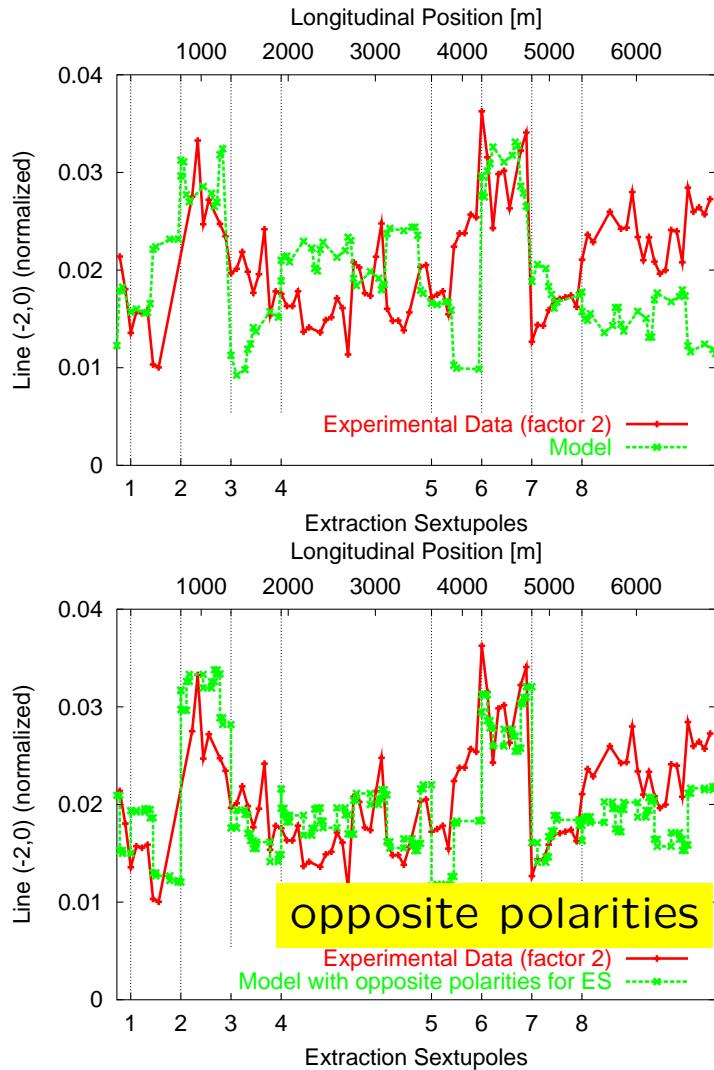
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Achievements in the SPS I



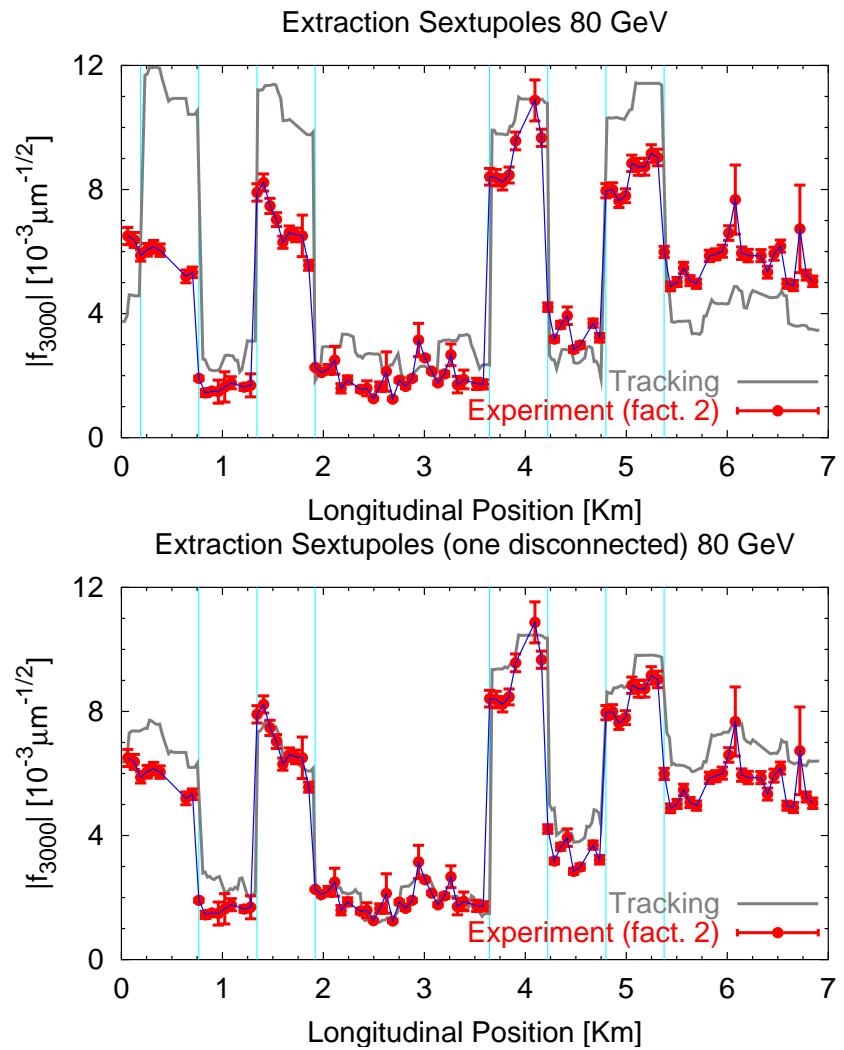
⇒ Measuring the coupling resonance term was a fast method to compensate coupling

Achievements in the SPS II



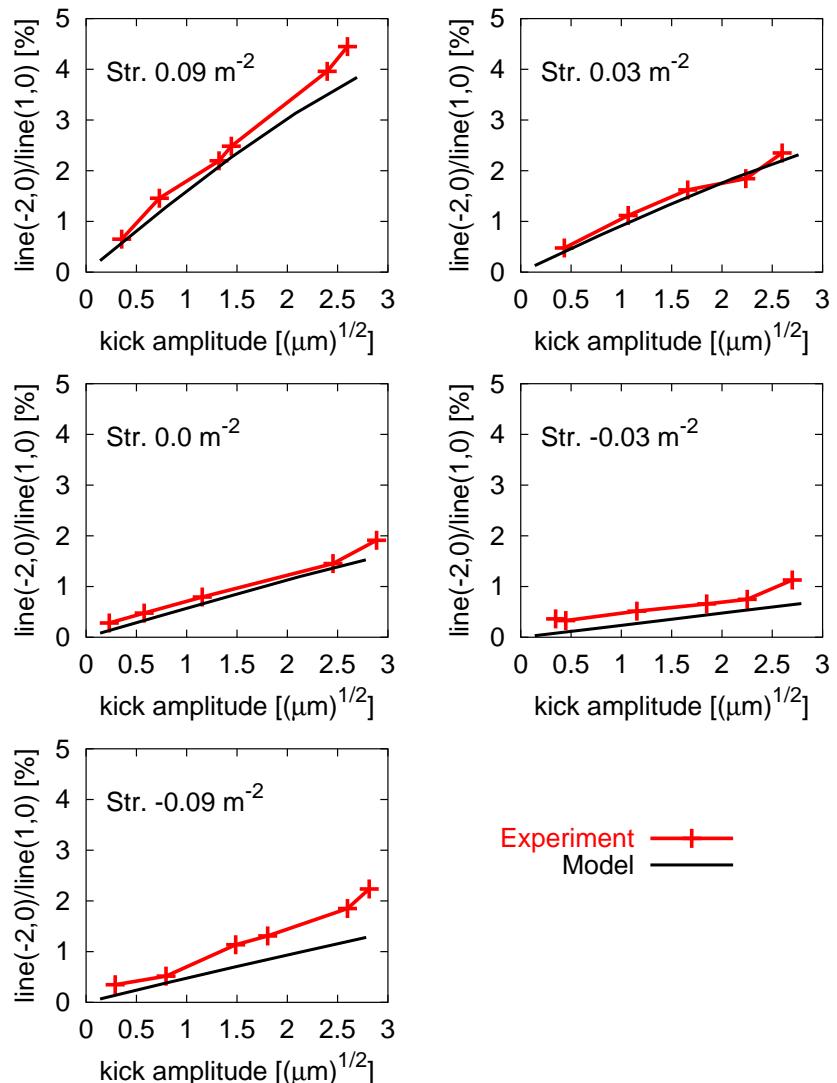
⇒ Measurements of resonances led to identify sextupoles with opposite polarities.

Achievements in the SPS III



⇒ and disconnected sextupoles too!

Achievements in RHIC



⇒ Sextupolar resonances were measured

New highlight: measure magnet strength I

The resonance terms have typically the form:

$$f_{3000}(s) \propto \sum_i L_i B_{2i} \beta_{xi}^{\frac{3}{2}} e^{-i3\phi_{xi}(s)}$$

Driving terms contain local information yet they are global.

⇒ If $f_{3000}(s)$ is available at enough locations $L_i B_{2i} \beta_{xi}^{\frac{3}{2}}$ are calculated by inverting the above relation (Andrea Franchi's idea)!

New highlight: measure magnet strength II

GSI SIS synchrotron simulation with 8 skew quads an 12 BPMs (Andrea):

SQ#	Measured	INPUT
1	-.1072E-03	-.1000E-03
2	-.1924E-03	-.2000E-03
4	-.3012E-03	-.3000E-03
6	-.3996E-03	-.4000E-03
7	0.4011E-03	0.4000E-03
8	0.2980E-03	0.3000E-03
10	0.2020E-03	0.2000E-03
12	0.9956E-04	0.1000E-03

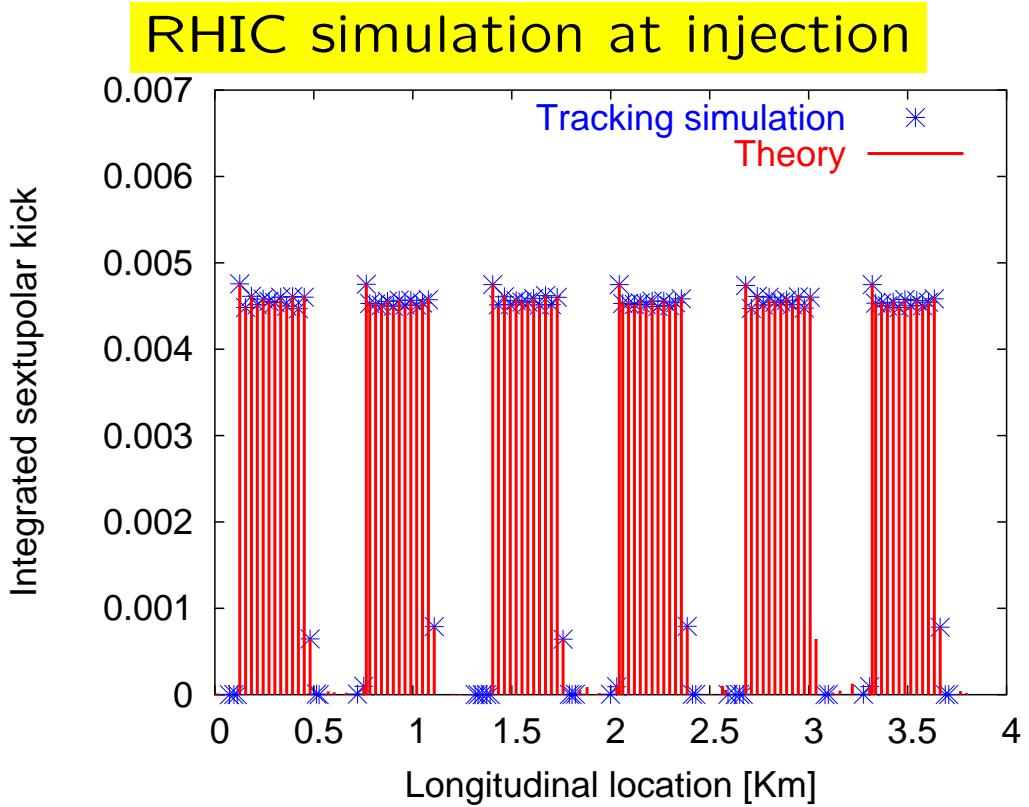
⇒ It works!

⇒ What if there are more multipoles than BPMs?

New highlight: measure magnet strength III

With 3 consecutive BPMs f_{jklm} are measured at the first two BPMs and their subtraction yields an integrated strength:

$$\overline{f}_{jklm}^{(2)} - \overline{f}_{jklm}^{(1)} = i \sum_{q=1}^n e^{i(1+k-j)\phi_{xq} + i(m-l)\phi_{yq}} \sin \phi_{xq} \ h_{qjklm}$$



RHIC Beam Experiment Proposal

Title: Measurement of multipole strengths from BPM data

Team: M. Bai, R. Calaga, W. Fisher, Andrea Franchi (GSI), Giovanni Rumolo (GSI) and R. Tomás

Experiment Goal: Measurement of **local** skew quadrupoles and sextupoles strengths

Description: Free or forced betatron oscillations are excited at different amplitudes and turn-by-turn BPM data are recorded.

Instrumentation: BPMs, Tune-meter kickers, injection kicker and AC dipole (H & V)

Data Analysis: FFT (SUSSIX), Action-Phase, SVD (MIA), ...